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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/887,035	06/25/2001	Ramkumar Subramanian	039153-0381	7414

7590 06/05/2003

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EXAMINER

SAGAR, KRIPA

ART UNIT

PAPER NUMBER

1756

DATE MAILED: 06/05/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/887,035

Applicant(s)

SUBRAMANIAN ET AL.

Examiner

Kripa Sagar

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period of Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 March 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-38 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-38 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 25 June 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

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DETAILED ACTION

Response to Amendment

1. The amendment filed on 3/18/03 has been entered. Claims 2-5, 15,16,29,30 have been amended. New claims 33-38 have been added; no new matter has been added. Claims 1-38 are under consideration.
2. The affidavit filed on 3/18/03 under 37 CFR 1.131 is sufficient to overcome the Mansfield reference.

Claim Rejections - 35 USC § 112

3. The amendment is sufficient to overcome the rejections under 35USC 112 presented in the earlier office action.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

-
5. Claims 1-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Pat.6218089 to Pierrat in view of US Pat.6337162 to Irie and further in view of US PGPUB 2002/0001758 to Petersen and further in view of US Pat. 6309800 to Okamoto.

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The instant claims recite patterning a photoresist layer over a first layer, with two dissimilar masks under differing illumination conditions. The first mask may comprise dense patterns while the second mask may comprise isolated patterns. The illumination conditions include focus, numerical aperture, partial coherence and the like. The exposed photoresist is patterned and the pattern is transferred to the first layer. The etched first layer is filled with a conductive material. Semiconductor devices may be built up by this process. The process windows for the two exposures do not overlap.

The instant claims are taught by Pierrat whose teachings have been discussed, with specific citations, in the earlier office action with reference to claim 1. It teaches conventional photolithographic processes of forming a photo-resist layer over a substrate, exposing and patterning it with a mask and transferring the pattern to a lower layer (1;58-2;6). It teaches diverse methods of patterning dense and isolated features with improved image fidelity. In one embodiment the dense features on a mask are exposed with a first optimal exposure setting; isolated features on the mask are again exposed with a second setting optimized for those features (4;29-50).

Pierrat teaches overlay exposures with multiple masks; but it does not teach separation of features by pitch on to two or more masks. It does not teach non-overlapping process windows. It does not teach built-up multilayer devices.

Irie teaches a method of forming a pattern by multiple exposures of sub-patterns (Fig.1). It teaches that the sub-patterns may be formed based on the pitch. Dense patterns may be formed on one mask while isolated features are formed on another

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mask (22; 23-28). Irie teaches that the exposure conditions may be optimized for each mask (22;30-36).

Irie does not discuss process windows or device fabrication.

This is demonstrated by Petersen, wherein masks with two different pitches (400nm and 600 nm) have non-overlapping process windows (Fig.19C,D). In another embodiment two masks are designed with a common process window (Fig.21I). The choice would be guided, among other factors, by the exposure apparatus and process flow. It may be noted that Petersen teaches focus as an exposure variable (#0152; last line) suggesting that dense and isolated patterns may not have a common process window even if the CD (critical dimension) is the same.

Petersen does not teach a built up multilevel device.

Okamoto teaches this as discussed in the previous office action.

The combination of Pierrat, Irie, Petersen and Okamoto lead to the instant invention. This combination would have been obvious to one of ordinary skill in the art for the following reasons: Pierrat, Irie, and Petersen attempt to solve the same problem viz. patterning dense and isolated features on a photoresist with true image fidelity. The three references teach the separation of isolated and dense features and exposure with optimal illuminating conditions. Irie and Petersen teach separating the features on two or more masks for multiple exposures because Petersen realizes that there may be no common focus, exposure conditions for the two (#0152) while Irie teaches that separation on two or more masks facilitates optimizing the exposure conditions (22;23-63). Okamoto teaches a conventional method of successfully forming devices with

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multiple levels of metallization using the processes similar to Pierrat's, Irie's and Petersen's.

Response to Arguments

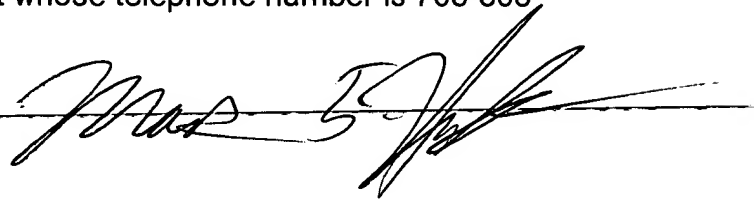
6. Applicant's arguments with reference to the rejection of claims under Pierrat and Neisser have become moot in view of the new rejections.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kripa Sagar whose telephone number is 703-605-4427. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark F Huff can be reached on 703-308-2464. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

A handwritten signature in black ink, appearing to read "Mark F. Huff", is written over a horizontal line.

MH/ks
June 2, 2003

**MARK F. HUFF
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700**